HUMBOLDT STATE UNIVERSITY

STUDENT CHAPTER
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ENVIRONMENTAL RESOURCES ENGINEERING

ERE MESSENGER

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Geology Field Camp

by Mike Anderson

I am driving east on State 178 though the early evening of May 31, on the last 40 miles of my eleven-hour trip from Arcata, through Bakersfield, along the spectacular Cataracts of the Kern, and on to Lake Isabella. I know business has been slow, considering the good weather and flow conditions, but still I am looking forward to my fourth year as a guide for Whitewater Voyages on the Kern River.

Now it is Tuesday, June 11, and I have three days off. I consider hiking or kayaking the upper Kern, but decide on a drive to some part of eastern California I haven't seen before. Dig out the maps; maybe the Mono Lake area. But then I see Hans Abramson- "Hello, Hans!"- another Voyages guide and an HSU Geology grad student I met the previous summer while training on the North Stanislaus River. Turns out he is participating in the six-week HSU Geology field camp just east of Owens Valley, and is using his Tuesday day off to train on the Lower Kern. What a great idea! Follow Hans back to camp and surprise Gary Carver.

At just past 9 PM Hans has showered and is ready to go, after surviving the pickup basketball game. So, where are we going? And how do we get there? It is a two-hour drive. First, east on State 178 to State 14 at Freeman Junction. Look across the spectacular desert night to the lights of Ridgecrest and the US Naval Weapons Station at China Lake. Go north on State 14 to the junction with US 395, and continue north to Olancha. Now east on State 190 toward Death Valley, but turn north onto State 136. At Keeler turn east off the paved road and watch the remaining civilization recede in the rear view mirror.

What is this place? Where is it? Well, it is in the desert, just east of Owens Valley. Now, Lake Isabella is in the desert, but this is serious desert. Yet, as the crow flies, it is only 25 miles east of Mt Whitney, the highest point in the contiguous United States. More precisely, it is at longitude 117½50' 00" west (from Greenwich), latitude 36½32' 30" north. It is the Cerro Gordo Mining District, Inyo Mountains, California.

Still half asleep at 6 AM, I roll out of the back of my pickup and open my eyes. WOW! Looking west I see the Sierras rising up out of Owens Valley. But, interestingly, from this vantage point you can't easily tell which of the peaks is Whitney. Now, surveying the area around me, I see that the camp is clean and well-organized. More importantly, I see the students and staff congregating around the cook tent.

Gary Carver is sitting in a chair talking to students, and I walk up and say Hello. He is surprised! and I think pleased to see me. Apparently, I am the first non-geology faculty member to visit during the 15 years he has used this site for the camp. He immediately invites me to spend the day working with the students on their project, and I accept without hesitation. Meanwhile, I help myself to breakfast, choosing from pancakes, cereal, meat, muffins and fruit. A great spread. I meet Kat, the cook, and Steve, the camp manager (both HSU alumni, now at Northern Arizona State University), and some of the students. It turns out not all of the 30 students are from HSU; nine are from SFSU which

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In This Issue

THREE ERE GRADS IN UNIV TEACHING AND RESEARCH

The following biographies represent a sampling of the twelve ERE graduates now teaching and researching at universities across the U. S.

Brett Borup, BS ERE, 1980

I started my academic career in 1985, at Tennessee Technological University, teaching in the Civil Engineering Department and doing research in the State's Center for the Management, Protection and Utilization of Water Resources. During the summer of 1986 I was awarded an American Assn for the Advancement of Science, Environmental Science and Engineering Fellowship. I spent the summer working as a consultant to the US EPA in the Office of Research and Development. After two and one half years at Tennessee Tech I accepted an appointment as an Associate Professor at Brigham Young University. I teach mainly graduate level water and wastewater unit process classes, but once in a while I teach an undergraduate class like Civil Engineering Systems or even Statics. I love teaching! It's fun to think that there are a couple of hundred engineers out there helping to solve water quality problems at least partly based on the knowledge that I helped them obtain. My research is mostly in the area of physical/chemical unit processes. I have published several papers on Advanced Oxidation Processes, and several on the use of risk assessment techniques to determine water quality and treatment standards. From 1995 I was on a professional development leave from the university. I lived in Hawaii and worked on the improvement and expansion of a wastewater treatment facility in the community of Laie with Drs. Gearheart and Finney from HSU. It was a good opportunity for some practical application.

For information on all twelve ERE graduates now teaching and researching at universities across the U. S., see ERE GRADS IN UNIVERSITY TEACHING AND RESEARCH on page 6.

Sarina Ergas, B.S. ERE 1988

After much encouragement from the faculty at Humbolt State University, especially Mac McKee and Charles Chamberlin, I went on to UC Davis where I compleated M.S. and Ph.D. degrees in Civil and Environmental engineering. At Davis I worked under Dr. Edward D. Schroeder. My master's research was a study of biological treatment of selenium contaminated drainage water from the San Joaquin Valley using anoxic fluidized bed reactors. My dissertation research focused on biofiltration of volatile organic compound emissions.

In 1994, I became an assistant professor at the University of Massachusetts, Amherst in the Dept. of Civil and Environmental Engineering. I am currently teaching courses in Biological Processes, Air Quality, Groundwater, and Environmental Analysis. My research is focused on systems for biological treatment of Air Pollutants including biofilters, biotrickling filters, and membrane bioscrubbers. I am also collaborating with other UMass faculty on bioventing and biological drinking water treatment research.

I enjoy both teaching and research very much. I currently have seven graduate students working with me conducting research. I teach three to four courses per year including both undergraduate and graduate courses. I am also active in the college of engineering as the honors program coordinator and active in recruiting new students for our undergraduate and graduate programs. I try to keep active in the profession of environmental engineering, particularly with the Air and Waste Management Association.

I am married to another Humbold grad, Jim Bumgardner, who recieved his B.S. in ERE in 1988 and his M.S. from UC Davis in the Water Resources area in 1990. Jim is currently working for a regional economic modelling firm in Hadley, Massachusetts. His firm looks at the economic impacts of various projects and policies, particularly environmental regulations. We have two children, Rosa who is 21 years old and a junior at UMass in Biology and Anthropology, and Jake who is 7 and a math wiz.

We have eight faculty members in environmental engineering and a strong focus on fundamentals of environmental chemistry, microbiology, and transport processes. Any Humboldt students interested in coming to UMass for grad school are welcome to contact me at 413-545-3424 or ergas@ecs.umass.edu.

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ERESA VISITS CORVALLIS

by Matt Dodge

On Thursday afternoon, October 10, twelve ERESA members, Pro fessors Mike Anderson and Beth Eschenbach, and bus driver extaordinaire Art Reeve jammed to Corvallis, Oregon for two days of visits to the Environmental Protection Agency, Hewlett-Packard, CH2M HILL, and Oregon State University. We had great accommodations at Friendship House, a Quaker house near OSU, and on Friday evening we were hosted to a terrific pizza dinner by Beth's friend John Selker of the OSU Bioresource Engineering Department. We were pretty mellow on the ride to Corvallis, but on the way back to Arcata Saturday evening Beth got out her guitar and we sang nearly all the good campfire songs ever written., and a few others to boot.

The purpose of the trip was for ERE students to see what types of jobs and graduate school opportunities are available, and to get exposure to working environments where research and data collection are important parts of solving environmental problems

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Our EPA contacts, Paul Rygiewicz and Ron Waschmann, were very enthusiastic about their work, and this rubbed off on all of us. We were soon absorbed with the experimental setup and the science and technology associated with the project.

Under the Global Change Research Program, the effects of global warming on the Pacific Northwest forest species is the latest study at the E.P.A. Lab in Corvallis, Oregon. Global warming is caused by the rise in concentration of greenhouse gases, such as carbon dioxide, methane, nitrous oxide, ozone and chlorofluorocarbons, that get trapped in the atmosphere. As a result, the air warms up causing a climate change on the earth. How will a higher level of carbon dioxide effect a tree's photosynthesis and releasing of oxygen? After collecting enough data, the lab will be able to understand this. It is speculated that the trees may store excess carbon dioxide by adding more bulk, and the increase in carbon dioxide concentration will increase photosynthesis and tree growth.

However, it is projected that the atmosphere will warm considerably and drought conditions will worsen in the Pacific Northwest, resulting in a slowing of tree growth, a weakening of tree structure, and the release of more carbon dioxide into the atmosphere as the soil decomposes due to the increase of soil temperature. To understand more about the effects of carbon dioxide and climate changes on forest trees the Terrestrial Ecophysiological Research Area Project, or the TERA Project, was created.

To make predictions about the future of forest resources, the TERA Project was developed as a series of experimental studies that stimulate forest ecology in a controlled environment. Oregon was chosen as the site for this project partly because the Pacific Northwest grows one of the most versatile and valuable timer crops in the world, Douglas Fir.

The TERA Project is helping researchers explore the effects of carbon dioxide and climate change by monitoring tree growth, atmosphere, temperature, moisture and soil conditions in a miniature controlled environment known as a Terracosm. Scientists monitor the change in leaf area, temperature, and carbon dioxide concentrations with sensors that are hooked up to a system of data collecting computers. In addition, horizontal channels were incorporated into the different layers of soil so a video camera could be inserted to record visual changes. EPA scientists monitor the absorption of water by the roots and soil, the number and growth of roots and root tips, and the amount of carbon dioxide released in the soil in order to further understand the effects of the simulated environments.

Twelve Terracosms were built to study several different environments at one time. For example, one Terracosm will have excess carbon dioxide while another will have an elevated temperature. While controlling the climate, temperature and carbon dioxide concentrations within each Terracosm, data is collected representing the different environments

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GEOLOGY

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does not offer its own field camp.

During breakfast I learn that the field camp is really two courses: GEOL 471, Field Mapping Techniques, and GEOL 473, Geologic Report Writing, with GEOL 470, Field Methods, a prerequisite. The course is made up primarily of junior and senior students, with a few graduate students as well. And this site (Cerro Gordo) is not the only one used. For example, the 1995 field camp was located 30 miles north at Mazourka Canyon.

The purpose of the camp, beyond gaining general field skills, is to develop a geologic map of the area and use this map to estimate the geologic history of the area. During the first weeks of the camp the class was broken into teams of four to five persons each. The teams examined aerial photos, locating major geologic features, and divided the 30-square-kilometer study area into 1-km x 1-km sub-units. They also had a good start on gathering field data to bring detail to the map. The job today will be to continue this latter activity, and I will join Hans' team.

After breakfast we return to the kitchen and make meat or PB&J sandwiches and add cookies for lunch in the field, and we fill our water bottles. Dress for the day is hiking boots, shorts, shirt, wide-brimmed hat, dark glasses, and lots of sun screen. In early morning it is already HOT. Geology Department 4x4 camp vehicles take us out to our dropoff points, each group going to a different 1-km x 1-km sub-unit. To gather the information needed, we spend six hours hiking, climbing and assessing our sub-unit. Throughout, members of the group are identifying rocks, measuring strike and dip, locating folds and faults, and identifying geologic units and contacts between units. There is clear consensus on some points, and considerable discussion and debate on others. This is an exceptional learning environment.

The Cerro Gordo site is composed of six structural units: quaternary, tertiary, triassic, permian, pennsylvanian/permian, and mississippian. Careful field analysis showes our sub-unit to be comprised of six identifiable material combinations, all part of the permian structural unit: limestone, argillite and shale; quartzite, dolomite, limestone and conglomerate; quartzite, limestone and shale; argillite and quartzite; massive quartzite; and argillite. Thus, the map of our sub-unit is made up of closed lines outlining and separating regions containing these various material combinations, with strike and dip, and fold and fault information superimposed.

At about 3 PM, we are finished and start the long hike back to the pick up point. It seems blasting hot to me, but I am assured that it was much hotter the previous week! When we get back to the road we wait about a half hour for the trucks to pick us up. Finally, back to camp and shade. But work continues. The students must now fit their individual maps together to form a single map of the entire Cerro Gordo site. Throughout, Gary works primarily as a consultant. Later, we break for dinner: ham(tofu for some of us)bergers, garlic and basil pasta, green salad, bread and dessert. Then, a camp meeting, to discuss how things went today and determine what needs to be accomplished tomorrow. Finally, it is after 8 PM and I say my thanks and goodbyes. Later, when summer is over and we have all returned to school, Hans will bring the completed map over to show me the results of all their labor. Based on the map and their analysis of it, the students will establish that Cerro Gordo has seen six different mountain-forming events over the past 300 to 400 million years.

Meanwhile, on my way back to Lake Isabella, I reflect on the incredible, full day I have lived. I am tired to be sure. But amazed at how much learning has taken place. It has all reinforced what I have known for some time: that Gary and his colleagues in the HSU Geology Department have formed and maintained one of the best departments at the university. ERESA

ALUMNI

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Daene McKinney, BS ERE, 1986

I earned my Ph.D. in Civil Engineering with a major in Water resources Engineering at Cornell University in 1990. After working for the US EPA for one year as an environmental engineer and hydrogeologist, I joined the faculty of the Department of Civil Engineering at the University of Texas at Austin, where I am an Associate Professor in the Environmental and Water Resources Engineering program. I serve as an Associate Editor of the ASCE Journal of Water Resource Planning and Management, as the Vice-chair of the ASCE Water Resource Systems Committee, as a member of the Board of Directors and a member of the International Committee of the Universities Council on Water Resources (UCOWR), and as a Permanent Observer from the International Water Resources Association (IWRA) to the International Commission on Irrigation and Drainage (ICID), Aral Sea Study Program. I teach undergraduate courses in Fluid Mechanics, Numerical Methods, and Hydrology, and graduate courses in Water Resources Planning and Management and Numerical Methods for Environmental Engineers. My research interests include developing and applying numerical methods for simulation, optimization, and uncertainty analysis of water resources management problems, and the development of laboratory and field experimental techniques for the characterization and remediation of aquifer and groundwater contamination. My current research includes: (1) characterization of subsurface nonaqueous phase liquid (NAPL) contamination, (2) modeling bioremediation in NAPL contaminated aquifers, (3) optimal aquifer management and restoration, (4) expert geographic information systems (GIS) for water and environmental management, (5) large-scale water balance computations, and (6) risk-based decision analysis approaches for contaminated aquifers. ERESA

IS THERE A SANTA CLAUS?

from SPY magazine (January, 1990)

With research help from that renowned scien tific journal SPY magazine, here is the latest and most complete scientific inquiry ever carried out into the myth and reality of Santa Claus.

1. No known species of reindeer can fly. BUT there are 300,000 species of living organisms yet to be classified, and while most of these are insects and germs, this does not COMPLETELY rule out flying reindeer which only Santa has ever seen.

2. There are 2 billion children (persons under 18) in the world. BUT since Santa apparently doesn't handle Muslim, Hindu, Jewish, Buddhist and other non-Christian children, that reduces the workload to 15% of the total (378 million according to Population Reference Bureau). At an average (census) rate of 3.5 children per household, that works out to 91.8 million homes. And one presumes there is at least ONE good child in each.

3. Santa has 31 hours of Christmas to work with, thanks to the different time zones and the rotation of the earth, assuming he travels east to west (which seems logical). This works out to 822.6 visits per second. This is to say that for each Christian household with at least one good child, Santa has 1/1000th of a second to park, hop out of the sleigh, jump down the chimney, fill the stockings, distribute the remaining presents under the tree, eat whatever snacks have been left, get back up the chimney, get back into the sleigh and move on to the next house. Assuming that these 91.8 million stops are evenly distributed around the earth (which, of course, we know to be false, but for the purposes of our calculations we will accept), we are now talking about 0.78 miles per household, and a total trip of 75 million miles, not counting stops to do what most of us must do at least once every 31 hours, plus eat, rest and be merry, etc. This means that Santa's sleigh is moving at 650 miles per second, 3,000 times the speed of sound. For purposes of comparison, the fastest man made vehicle on earth, the Ulysses space probe, moves at a poky 27.4 miles per second. A conventional reindeer can run, tops, 15 miles per hour.

4. The payload on the sleigh adds another interesting element. Assuming that each child gets nothing more than a medium-sized lego set (2 lbs), the sleigh is carrying 321,300 tons, not counting Santa, who is invariably described as overweight. On land, conventional reindeer can pull no more than 300 pounds. Even granting that "flying reindeer" (see point #1) could pull TEN TIMES the normal amount, we cannot do the job with eight, or even nine reindeer. We need 214,200 reindeer. This increases the payload, not even counting the weight of the sleigh, to 353,430 tons. Again, for comparison - this is four times the weight of the Queen Elizabeth (That's the ship).

5. Now, 353,000 tons traveling at 650 miles per second creates enormous air resistance (this will heat the reindeer up in the same fashion as spacecraft reentering the earth's atmosphere). The lead pair of reindeer will absorb 14.3 QUINTILLION joules of energy per second. Each. In short, they will burst into flame almost instantaneously, exposing the reindeer behind them, and create deafening sonic booms in their wake. The entire reindeer team will be vaporized within 4.26 thousandths of a second. Santa, meanwhile, will be subjected to centrifugal forces 17,500.06 times greater than gravity. A 250-pound Santa (which seems ludicrously slim) would be pinned to the back of his sleigh by 4,315,015 pounds of force.

SO, if Santa ever DID deliver presents on Christmas Eve, he's probably dead now. ERESA

CALENDAR

We invite you to take part in these Spring 1997 activities.

JANUARY
Welcome Picnic

FEBRUARY
MathCounts
ASCE Student Leadership Conf
ASCE Mock Job Interviews

MARCH
Comedy Night

APRIL
5th Annual Rafting Trip
Spring Picnic
Awards Banquet

MAY
Graduation Reception

ERE GRADS IN UNIVERSITY TEACHING AND RESEARCH

by Mike Anderson

HSU Environmental Resources Engineering graduates have been accepted to graduate schools in record numbers since our first students graduated in 1972. Approximately 30% of these graduates have completed at least their Masters Degrees, and many have gone on to complete their doctorates. Twelve (or more?) of these chose to continue their professional careers at universities. The following list accounts for all ERE grads that we know of currently working in university teaching and/or research. Let us know of other names that should be on the list.

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SCHATZ
ENERGY RESEARCH CENTER

update by
Christine Parra

So much has happened here at SERC over the past year, it's difficult to know where to begin with this update! Last November we had just unveiled our prototype fuel cell powered personal utility vehicle in the Palm Desert golf cart parade. In the year since then, we've ventured out into the big world:

- we've experienced government contracting with a grant from the U.S. Department of Energy;
- our vehicle has been showcased in the Los Angeles Eco-Expo and Fleet Auto Show, as well as at the California Energy Commission and the California Air Resources Board in Sacramento;
- we've been written up in *Scientific American*, *Motorland*, *Popular Science*, and numerous newspapers;
- we've had the British Broadcasting Corporation (BBC) make a film at our lab for a special report; and
- we now have a great set of web pages, thanks to Professor Beth Eschenbach's ENGR 111 class.

But, for the sake of new readers, let's step back for a moment and look at who we are, what we are doing, and why.

The Schatz Energy Research Center (SERC), now seven years old, was founded to help solve some of the world's energy and pollution problems. How? By developing hydrogen technology to store solar energy cleanly. The main focus of our research is to produce fuel cells for stationary and mobile power systems. Fuel cells produce electricity from hydrogen, which can be generated from solar or wind energy. That electricity can be used to power our homes, cars, and industries. The only by-product? Pure water.

At our fuel cell lab on campus, the biggest project to date is to build a fleet of fuel cell powered personal utility vehicles and neighborhood electric vehicles for the City of Palm Desert, California. These retrofitted golf carts and small cars will use hydrogen produced at SERC's solar hydrogen generating station near the city center. When you consider that as much as 60% of smog is due to motor vehicles, this project could be an important step to cleaning up the air in our nation's cities. The $3.9 million Palm Desert project will prove that it's possible to run our cars on solar energy and to do so safely and with zero pollution.

This is an exciting time for hydrogen research. In early October President Clinton signed the Hydrogen Future Act, which provides increasing spending authorization for the U.S. Department of Energy (DoE) Hydrogen Program. While this year's DoE hydrogen budget is only $15 million, by the year 2001, $40 million will be authorized.

Almost every major car company has a hydrogen/electric vehicle research project (yes, count them off: GM, Ford, Chrysler, Honda, Toyota, Mazda, Mercedes, Volkswagen, and others). Daimler Benz and Toyota have both produced fuel cell powered cars, and several minicipalities have contracted with Ballard Power Systems for fuel cell powered buses.

Hydrogen seems to be the new buzzword. Pundits plan hydrogen

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ERESA

infrastructures, calculate the effect on automobile emissions, discuss consumer preferences and market strategy, predict all manner of cost scenarios, and refer to the "hydrogen economy." Our weekly news scans have yielded stories about hydrogen, fuel cells, and electric vehicles in major newspapers and magazines almost every day. It seems the day when America can finally kick the oil habit that causes a $60 billion/year trade deficit is just around the corner.

But wait a minute. Nothing's that simple. Just this year the Big Three auto companies (GM, Ford, Chrysler) won their battle against California's electric vehicle mandates. And while authorizing $15 million to hydrogen is indeed a step in the right direction, it's a puny sum compared to the amount earmarked for nuclear fusion: $232.5 million. Finally, while America will probably have invested $145 million in hydrogen research by the year 2000, some economists predict that we need to invest billions of dollars to make fuel cells cost competitive with batteries.

Now, what about the electric car idea? Many in the hydrogen field hope that people will adopt (as second cars) the efficient neighborhood electric vehicle—a small, inexpensive car that has a limited range and goes a maximum of 40 mph. But this will not happen unless American consumers become more concerned about fuel efficiency than they are now: The EPA's 10 most fuel efficient cars accounted for a meager 1 percent of all passenger car sales in 1994. This, despite the fact that most of these cars are comparatively inexpensive.

The problem is that gasoline at the pump is less expensive than it has ever been before, if you account for inflation.This makes it painless for us to choose cars based on their power or size, even if they guzzle gas. Small vehicles that get 40 to 60 mpg are doing quite well in France, for example, where gasoline costs about $5.50/gallon.

Many say that market forces should determine what sources of energy we choose. But if we added the cost of Persian Gulf security to the price of gasoline, prices at the pump would quadruple. Market forces are fine to depend upon as long as you eliminate subsidies. In addition, our current economic system has no way of accounting for depletion of resources. This means that the law of supply and demand (which would cause a gradual increase in market price as world supply decreases) is not at work with fossil fuels. (Read Paul Hawken's *Ecology of Commerce* for more on this.)

Here at SERC we know that all worthwhile changes take time. While we too look forward to the day when fuel cells become mass market items, our current focus must be to prepare the technology for that day.

On August 31 we delivered the first of a fleet of hydrogen powered fuel cell vehicles to the City of Palm Desert, California. It's a regular golf cart with its original 2 hp electric motor. SERC replaced the cart's six lead-acid batteries with a proton exchange membrane fuel cell power system. The 5 kW stack has 64 cells and consumes about 0.29 kWh of hydrogen per mile, with an efficiency of 125 miles per gallon of gasoline energy equivalent. The power system for the vehicle took 8 months to build and includes air delivery, fuel storage, cooling, electrical, and software subsystems.

The cart we delivered is America's first delivered fuel cell powered vehicle. But there's a lot of work yet to do. We're making progress on hydride storage, which allows denser storage of hydrogen, thereby increasing range, and is a great step toward a safer car. We're working with the country's most experienced hydrogen safety experts in designing the solar hydrogen facility and the vehicles. We're still making improvements in fuel cell design—the same size fuel cell stack now yields nearly 7 kW instead of the original 4—and there's a patent pending on our design. All in all, it's been a productive year in our mission to help secure a sustainable energy future.

ERESA

ERESA VISITS

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and results will be obtained in a shorter amount of time.

Monitoring of the Douglas Fir seedlings takes a minimum of three to four years. With approximately three years of studies completed, EPA scientists will soon be able to understand and predict the response of the Douglas Fir, and other forest species, to changing climate and increased levels of carbon dioxide.

Hewlett-Packard

Scott Bischke and John Mc Nabb met us in the entrance area of the plush Hewlet-Packard office. After signing us in and providing us with safety glasses, we split into two groups for the tour. HP uses significant amounts of precious metals such as gold in the production of computer and peripheral components, and is putting considerable effort and money into removing even trace amounts of these valuable materials. We were introduced to the latest technology for recovering these materials. After the tour, we all understood how important it is to remember our chemistry!

CH2M HILL

Formed in Corvallis, Oregon in 1964, the engineering consulting firm, CH2M HILL, has since branched out internationally with corporate headquarters in Denver, Colorado. CH2M HILL, with offices on six continents, has 7,400 employees and $800M in annual gross revenues. They provide services for project engineering, development and finance, program management, process engineering, design, construction management, and operations. For instance, CH2M HILL'S Industrial Design Corporation worked with Motorola to design a state-of-the-art manufacturing facility in Tianjin, China. CH2M HILL also provided water quality and master planning services to Gwinnett County, Georgia. Locally, they are working with the Nature Conservancy, an international non-profit organization committed to conserving biological diversity and water sys-

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KANEKTOK SUMMER

by John Rupp

Please fasten your seat belts for out final approach to Bethel" our Lockheed Electra's captain alerted us over the intercom "Air temperature is 26 degrees and Bethel informs us that we will be greeted with sunny, clear skies". As the 1950's era four engine turboprop began to bank on final approach, I could see the outskirts of Bethel, Alaska on the banks of the massive sediment laden Kuskokwim river. To the right of me sat Jay Robeson, a seasoned Seattle area fishing guide seeking the same destination, a summer working as a fishing guide on the Kanektok river in Western Alaska. Judging by the look in his eyes as the Electra taxied in to the dilapidated terminal at Bethel, we might both be in for more than we expected.

The cold Spring wind slapped our faces as we descended the exit ramp. Jay stopped to inspect a frozen puddle on the runway. Looking up, he scanned the horizon and the endless miles of thawing tundra and mountains surrounding us. A nearly imperceptible grin cracked on his face as he looked at me incredulously. "This place is like being at the end of the world. I can't believe we're going to spend three months out THERE!" he exclaimed as his arm panned the horizon. "Jay, I know exactly how you feel". Even after two years of guiding on the Kanektok river for Alaska West sport fishing on my summer break from California's Humboldt State University, there was no mistaking the familiar feeling that we were leaving civilization and literally going to a place completely forgotten by the Twentieth century.

Within a half an hour we climbed back into the cloudless sky in a six seat Piper Cherokee. Our pilot, Vince, flew A-6 Corsairs in the Gulf War and somehow he must of thought that Piper Cherokee was some kind of primitive attack aircraft. Skimming the tundra like a Scud missile, we approached our final destination of Quinhagak .

We landed on a short gravel runway and taxied up to our waiting welcome party. "Jungle Gerry" Mcgowan, Mark "Inspector" Stephens, and Matt "Mattchanic"

ERESA VISITS

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tems, to shape political, regulatory and public discussions regarding the Klamath River Basin ecosystem in Oregon and California.

Our contacts were Calvin P. Noling, PE, Industrial Process Engineer and a graduate of our HSU ERE Program; Cindy Dahl, Group Leader, Waste Management; Lynette Bennett, Technical Assistant; and Jim Howland, one of CH2M HILL's four founders. Calvin and his associates shared some of their personal experiences at CH2M HILL with us. After listening to the job descriptions and activities that represent three different areas of engineering, it was understood how important it is to be able to work with other people as a group, and to understand and appreciate other peoples' technical expertise. Finally, we learned that ERE students are eligible for a cooperative education that CH2M HILL has.

Oregon State University

OSU has two very different environmental engineering graduate programs: Bioresources Engineering in the Department of Agricultural Engineering, and Environmental Engineering in the Department of Civil, Construction and Environmental Engineering. Our hosts for the former were Richard Cuenca and John Selker, and for the latter, Sandra Woods.

Bioresources Engineering involves large-scale, long term projects that combine field experimetation with math modeling. The focus is on technical, quantitative understanding and management of bioresources in the natural environment. They offer financial support to students at both the MS and PhD levels.

Environmental Engineering is a more traditional, even classical, program, with emphasis on unit processes and other processes for removing pollutants from gas and water streams. Experiments tend to be of smaller scale that can be carried out in the laboratory. Financial aid is available only for PhD students.

Both programs seem to be well supported and have enthusiastic faculty and students. ERE students interested in graduate school should consider OSU. ERESA

Sanders welcomed us to the sleepy Upik village of Quinhagak. Gerry and Mark had returned for another season guiding on the Kanektok, while Matt had returned as our life-saving mechanic. We loaded our gear into our eighteen foot jet boats for a short trip to Alaska West's camp, affectionately named by our crew as "Zoo Bar".

As we drove up river, Quinhagak rose off in the distance. Passing a subsistence gill net reminded me how important fishing was to the five hundred inhabitants of the village. In a matter of three months these Upik Eskimos would earn a large part of their income , as well as smoke enough fish to get through the winter.

Minutes later we pulled up to "Zoo Bar" on the banks of the Kanektok. The willows were still naked in the late May afternoon, unable to shield the Aklung and Kilbuk mountains from our gaze. The snow cover on the mountains betrayed the season; too little snow had fallen in the mildest winter in recent history. The gin-clear water punctuated the knowledge that this would be a low water year, perfect for plying the emerald Kanektok for its numerous salmon and trout. My spirits soared as the upcoming summer's events unfolded in my mind.

Snapping back to reality, Gerry's booming voice reminded me why we were here. "Hey guys, let's get started with set up. I want to finish so we can go fishing." Setting up Alaska West's sport fishing camp would take us nearly a month of back breaking work; finishing before schedule meant we would get to go fishing before our Anglers arrived in mid June.

Working seven days a week, ten to twelve hours a day, the camp began to slowly take shape. We had to be carpenters, plumbers, electricians, boat drivers, laborers, and camp cooks; self sufficiency is the only way to survive in the bush of Alaska.

One day while building an Arctic entry for the dining tent, Jay asked for my help in determining the slope of the roof to be installed. "Hey John, do you think you can figure out how to design the right roof for this entry?" Scratching my head and wandering off to find my calculator, trigonometric functions stimulated a recently unused portion of my brain. Given some measurements from Jay, and a couple of minutes to check my answers, I was able to rattle off what seemed like the solution to his problem. "O.K. engineer, that looks pretty good. Now let me show you how a carpenter solves this problem!" Using a simple carpenter's square, Jay was able to calculate the pitch and measurements in a matter of seconds with calculations scratched on the side of a two-by-four with a nail. Jay had taught me a valuable lesson that even though I have learned a lot of important skills in school, there are many more that will need to be learned

King and friend, Brice, beside the Kanektok.

from experience as I start to work in my field.

Time seemingly condensed as the middle of June arrived. Joined by the rest of Alaska West's crew, the finishing touches were put on the camp three days before the summer's first Anglers were to arrive. The Kanektok had already started to swell with unbelievable numbers of King salmon, chrome-plated vanguards of the summer salmon runs. Fishing at times until one or two o'clock in the morning, my fourteen foot state-of-the art double-handed fly rod seemed to almost constantly throb with the pulse of a salmon's screaming run. Landing and quickly thanking these silver beauties, I at times released as many as seven twenty plus pound Kings in a matter of a couple of hour's fishing.

Our first anglers arrived and the fishing season on the Kanektok launched into high gear. Chum and Sockeye made their appearance, and early season Rainbow trout woke up form their winter's rests. People from all over the country arrived at Alaska West's camp to fish one of the finest sport fishing rivers in the world. Not one left disappointed.

As the King run dwindled, our camp had a week off for the doldrums between runs. Planning months ahead for this event, I had two of my best friends arriving from Arcata for a week of fishing. Brice Dusi and Eric Rangel arrived in late July to a river that was lower and clearer than anyone had ever seen. We couldn't have prayed for better fly-fishing conditions.

After three hard days of running upriver to fish Rainbow trout and Arctic char, Brice, Eric, and I decided to stay down river and try to find some early run Silver salmon.

We had all spent countless fishless hours together on our rivers back home fishing for Steelhead and Kings with a fly on the Smith, Klamath, and Trinity rivers with only occasional hook-ups. In contrast, as if an answer to our dreams, the earliest and largest Silver salmon run in recorded history was beginning to start on the Kanektok. In that first day of fishing for Silvers, we caught more fish than most do during the peak of the Silver run. We couldn't believe the way the Silvers sought to punish our flies, smashing at them furiously and dashing away in spectacular leaps and runs.

With the climbing of the sun over the following morning's blood red sky came the realization that we might be able to accomplish the highly sought-after "Pacific Salmon Grand Slam", landing all five species of Pacific salmon in one day on one river with a fly. By one o'clock in the afternoon Brice had already landed four of the species (Silver, Pink, Chum, Sockeye) and we started our quest for a King, the hardest of all Pacific salmon to catch on a fly rod.

Switching to heavier gear and different tactics, I took Brice to one of my favorite spots to catch a King. After showing Brice a likely drift, I turned for the boat to get my rod. Just as I reached the boat, the screech of Brice's drag told me he had hooked a King. "John, I can't even begin to control this fish" screamed Brice as line peeled off his reel at alarming speed. Without hesitation I threw the anchor on the bow and I pushed off as hard as I could. Firing up the engine, I launched the boat directly at Brice. Without the boat the King would wrap itself up in the submerged trees directly down river from Brice. "Hop in!" I said to Brice as I jumped out to hold the boat "If we don't do something fast we'll never catch that fish!" Sliding into the racing current, Brice and I worked down to the fish as quickly as possible without giving it too much slack. "Oh no" was all I could say once I realized the fish had wrapped itself around some submerged tree roots "we are going to have to try and get that fish off of that root wad. Hang on and watch your rod tip. I'm going to try to free that fish. " Brice muttered something unprintable under his breath as I started circling the root wad in the pounding current. "He's still there John but I can't seem to pull him off. Try going around the other way!" Slamming into reverse, I brought the boat around again and almost instantly I could see the line jerk. "He's free!" we both screamed as the line began to pulse erratically back into the current. Fighting hard for another half an hour, we finally were able to control the enormous fish. Brice hopped out of the boat as I pulled into a gravel bar almost a quarter mile downstream from where the fish had been hooked. Brice gently cradled the amazing creature for a quick photo, then thoughtfully revived the fish before its massive tail propelled it back into the glistening current. With a grin and a high-five, I looked Brice in the eye and laughed. "Way to go man, way to go."

The remaining days of summer slipped by as the autumn sky started to pelt rain upon the wind-swept tundra. My days on the Kanektok had come to an end; time to trade in my fly rod and jet boat for notebook and computer lab. Fall's first snowflakes fell on the night before my departure, reaffirming my need to leave. Standing on the edge of the gravel runway a blanket of snow stretched out across the hills and mountains in the distance. As the Piper Cherokee touched down on the airstrip the crisp air clawed at me, stirring memories of my arrival. But May was long gone, and it was time to go home and start the new semester. I know that someday soon I won't be able to look forward to my return to guiding, as the demands of my future Engineering career conflict with seasonal work. Despite this loss I will always be able to rekindle the magic, and hold on to the past. I think in some way, however small, my summers will always be spent on the Kanektok. ERESA

From MIT's Course Evaluation Guide, Fall 1991

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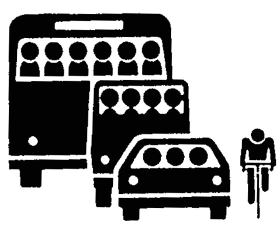

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